

crease of serous plethora and of body weight. To diminish the bread and meat of a person with serous plethora will make his blood poorer in albumen and in corpuscles and richer in water, and will still further increase the transudation into the lymph spaces and also his weight. The conditions for which reduction of weight is indicated are angina pectoris, any form of heart disease with decompensation, as shown by short breath, palpitation, edema of the feet, chronic bronchitis, with dyspnea and debility in plump middle aged persons without any obvious cause. Von Noorden says that reduction cures are indicated where chronic interstitial nephritis, rheumatism, gout, diabetes and tuberculosis are associated with obesity.

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THE COMMON RAT.*

WITH SOME SUGGESTIONS AS TO THE BEST METHODS FOR ITS DESTRUCTION.

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THE rat is classified by zoologists as follows: Class, mammalia; order, rodentia; family, Muridæ; sub-family, Murinæ, which contains over 15 genera. Of these we have to deal with only one genus, namely, *Mus*. This genus alone, however, contains over one hundred species, but fortunately only three have any interest to the medical or general public. They are in order of their importance: *Mus Decumanus*, *Mus Musculus* and *Mus Rattus*.

The *Mus Rattus*, or black rat, was originally a native of India and from there, by means of commerce, it has spread over the greater portion of the globe, destroying the original house-haunting species wherever they gained a foothold. They thus invaded the continent of Europe, England and America and were known as the "black rat," or "common rat" for nearly two centuries; when, owing to the invasion of their destroyer, the Norway rat, they have become almost extinct in the above-mentioned countries except parts of South America, where the lower type of development of the original species of rodents on the one hand, and the slower invasion of the Norway rat on the other, still enable it to exist to a certain extent. The body of the black rat seldom exceeds seven inches in length, while its tail is from eight to nine inches long. The color is usually bluish black, although an exception to this is met with in tropical countries where it assumes a reddish tint (the type known as *Mus Alexandrus*). The abdomen is somewhat lighter in color than other

parts of the body. Compared with the Norway rat it is mild and tamable in disposition, and is the ancestor of our white rats.

Mus Decumanus—By far the most important, if not the only species we, as sanitarians have to deal with, is *Mus Decumanus*, or the Norway rat. This term is a misnomer, as not only is this species a native of Western China where it is still found in a wild state, but Norway and northern Europe generally were invaded at a later period than was southern Europe and England. Their almost world-wide invasion, when once begun, was rapid and unobstructed. They entered Europe by way of Asia Minor and the Mediterranean ports; were carried from Gibraltar to Western Island and from thence to England. At a still later date they were imported to America. Wherever they landed they accommodated themselves to the conditions met with, and with surprising rapidity destroyed not only the preceding invaders—the black rat—but all of the house-haunting species of rodentia which still remained except *Mus Musculus* (or common mouse), which was protected by the small diameter of their burrows and their cautious natures.

In reading the older authors who witnessed the invasion of the Norway rat, we are led to infer that they were at that time even more predatory and ferocious than their descendants of the present day. Thus, in sections of Western Island, where they first made their landing, they completely destroyed the frog and even depopulated shallow fish ponds. Soon after this, in hopes of destroying the natural wood rat, which was doing great damage to the cane fields of Jamaica, the inhabitants introduced the Norway rat. This experiment had the result so frequently seen when a foreign animal is introduced into a country to destroy another species—they exterminated the wood rat promptly, but became a worse pest themselves. This species is of heavier build than the preceding, from eight to nine inches long; the head is bluff and rounded; ears short and broad; tail shorter than body and head combined; color of an uniform grayish-brown above and white below; ears, feet and tail of a flesh color. The color may vary considerably from the above type, even be quite black. The female bears from 15 to 50 young per year, which in turn are able to become mothers at five or six months of age. This wonderful productiveness, combined with its habits, ferocity, strength and cunning, make it proof against extinction by any of its natural enemies; and these qualities, together with its adaptability to almost any conditions, its great powers of destruction, and the fact that it is probably the greatest factor in the spread of a disease that in one outbreak caused the death of one-third of the population of Europe, puts even man on the defensive. To counterbalance its natural safeguards, two factors

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work to keep the number of the species within reasonable bounds, namely, the ratio of births is eight males to every three females, and that, while in times of plenty the rat is more of an epicure than he is generally accredited, in times of scarcity it becomes a cannibal, the stronger males devouring not only the weaker members of their sex, but it is stated even females and their young. While omnivorous, it prefers a diet composed largely of meat, and will take great risks to procure it. While all of the same species, differences in environments have caused a considerable difference in habits and appearance, in some cases amounting almost to a variety. The most important of these subdivisions are the sewer rat and the house rat. The former lives in sewers and about the water front. They are the largest and fiercest of their species, and are said to confine themselves strictly to this habitat. The other, the house rat, lives about dwellings, barns, etc., but unlike the sewer rat, is a great traveler, making frequent migrations to distant places, sometimes in large bodies as though by a common agreement.

The only other species of much importance, from either a sanitary or economic standpoint, is *Mus Musculus*, or the common house mouse. It, also, is an Indian invader, but, as before mentioned, the small diameter of its burrows enabled it to escape the fate of the black rat. Its chief habitat is the dwelling of man, although it is found less frequently in barns and warehouses; its presence in these places in any considerable number is a good indication that there are few or no members of *M. Decumanus* present.

In view of our lack of definite knowledge as to the habits of the rat, especially as to whether it confines its search for food to a limited area, or has a wide range; whether those found in sewers remain there, as has been claimed, or make frequent excursions to houses, it is better to apply measures of destruction to all areas infested, whether houses, sewers or wharves, rather than to direct our efforts to only one class of such places—sewers for example—trusting that those living in other places will find their way to the trap or poison. Another characteristic of this animal must be borne in mind when dealing with problems of rat destruction, that is, aside from the normal periodical migrations the rat is easily frightened by an unusual mortality, whether from poison or disease, and such an occurrence among them will sometimes cause the sudden departure of large numbers. Not only is this an important fact in the spread of diseases, but it may lead to errors in estimating the number of rats that have been destroyed, and thereby cause an undue confidence in the methods employed. Such a migration gives no permanent benefits, however, for not only do the original inhabitants return after a

time, but those from outlying and over-populated districts may seize the opportunity to enter the depopulated area, attracted by the greater abundance of food and the lesser competition; at any rate, the deserted district soon becomes reinfested. This latter factor adds greatly to the difficulties in the extermination of rats in a given district, success only inviting the influx of rats from surrounding places. In this connection it might be mentioned that one of the principal means by which seaports are kept infested by these rodents are ships, especially those carrying grain; and unless precautions are taken either to prevent rats from going aboard vessels at their port of departure, or methods are employed at the port of arrival, having in view either the destruction of rats aboard the vessels or the prevention of their landing, the chance of destroying them in a city with a large shipping becomes much more difficult.

Looking over the history of this animal that has been endowed by nature with qualifications sufficient to render it capable of, in less than three centuries, spreading over the whole world and holding without difficulty every foothold that it has obtained, we cannot expect that the task of its destruction will be either an easy or a short one; nor would it be reasonable to suppose that even if its destruction was accomplished in a given locality that it would be anything like permanent, unless measures were kept up; and it may be both hoped for and expected that at no very distant date it will be as much the duty of our municipal governments to destroy the rat as it is to enforce the removal of garbage; and then it will become the duty of our quarantine officials to destroy rats aboard vessels before they are allowed to dock; both the sanitary and commercial welfare will demand it.

The more common methods employed in the destruction of rats might be classed as follows: (1) poisoning with chemical substances; (2) infecting with Danyz's virus; (3) destroying by the use of predatory animals; (4) trapping; (5) killing with poisonous gases in confined areas; (6) construction of buildings and other methods tending to make entrance difficult or impossible; (7) use of substances disagreeable to the rat, causing him to leave a given locality; (8) the offering of rewards.

Poisoning With Chemical Substances is the most common method employed for the destruction of rats on a large scale. Its advantages are that it is cheap, easily applied and effective, and is probably no more liable to cause a premature panic among them than are other methods. Its disadvantages are that it is sometimes dangerous to people and domestic animals, both from the possibility of dogs, cats and even children eating the poisoned bait, or from the poisoned rodent

vomiting and contaminating food stuffs. Its safest and chief application is its use in sewers and other places not frequented by human beings or their pets. In the employment of this method we have to choose between two classes of drugs—those killing quickly and those causing death after a considerable lapse of time. The first class has the advantage of destroying the animal within a few moments after ingestion, thus preventing it from doing damage by food contamination; and when applied on a bait which cannot be dragged about, such as lard, and given such protection as is offered by a box open at either end and of small enough diameter to prevent anything larger than the rat from entering it, it is probably the safest class of chemical poisons that can be used. Its disadvantages are that the suddenness of death is apt to frighten the rats that may witness it and cause them to become suspicious of the bait. Of the quick poisons, strychnin and potassium cyanid are probably the best. Either of these may be applied on the bait, in substance, in solution or in the form of a paste made by rubbing up the chemical with lard or some similar material. As the presence of these chemicals will be detected by taste, it is well to have it of sufficient strength to insure death from one or two mouthfuls of the bait. The quantity of the substance necessary to cause death is, in the case of strychnin or potassium cyanid, very small. In a few experiments performed in our laboratory it was found that even a small amount of potassium cyanid was almost instantly fatal; one grain of strychnin killed in three minutes; one-third of a grain required over four hours, while in an unknown, but very small amount, death took place in 12, 24 and 36 hours respectively; so a bait of sufficient strength to insure the ingestion of at least two grains is to be desired if a rapid result is to be obtained.

The slow poisons have the advantage of not frightening away or causing suspicion among the unpoisoned rats; too long a time elapsing from cause to effect for even this sage to reason it out. The animal usually suffers for some time before death when poisoned with this class of drugs and (especially if water is not convenient) in its mad search for drink it frequently leaves the locality in which it sickened. This is an advantage when employed in a dwelling, as it may save the necessity of tearing up a floor to remove the source of the odor emanating from the dead rat. The disadvantages incident to the use of these poisons in dwellings or public places are the proneness to vomiting and the excessive thirst which they cause, which, while endeavoring to quench, may cause the animal to enter rooms containing food and drink and contaminating the same. Therefore, when such poisons are employed in dwellings, care should be taken to see that all foods and fluids are protected.

Of the slow poisons, phosphorous and arsenic are probably the best; and our experience here would lead us to conclude that the former is the more certain. The several "pastes" and "rat poisons" on the market owe their efficiency chiefly, if not entirely, to a mixture of the substances, and when employed on a small scale they are the most convenient form to use; but when required in large quantities it is economy to make the mixture, and this can be done by rubbing up five or ten per cent of the phosphorus or arsenic with some oily substance, such as lard, and applying the paste on cubes of rye bread, meat or fish. These should be placed in infested localities; the bait as well as the poison should be changed from time to time, in order that the rat may neither tire of it, nor become suspicious.

Infecting with Danyz's Virus.—This organism, discovered by Professor Danyz, is a bacillus of the para-colon group closely resembling and probably identical with the bacillus typhi-murium, the cause of a disease among mice (*Mus Musculus*). Danyz was able to raise the virulency of this organism to such a degree that it became as fatal to rats (*Mus Decumanus*) as the bacillus typhi-murium was to *Mus Musculus*. He further claimed that not only did it destroy rats that actually ate it, but that those, while ill, transmitted the disease to others, thus causing a progressive epizootic which would destroy rats without injuring man or other animals. The experiments of Passed Assistant Surgeon Roseneau, Director of the Public Health and Marine Hospital Laboratory in Washington, and a similar series of experiments performed in this city under the direction of Passed Assistant Surgeon Blue show that when this bacillus is fed to rats in the laboratory about from 50 to 90 per cent of the animals so treated succumb; that when healthy rats are shut up in small cages with those that have sickened, a small per cent only of the former become infected and die; and that those rats which sicken and recover are immune to subsequent infection.

To summarize and apply the knowledge obtained from these experiments: Rats which actually eat the virus die with almost the same certainty that attends ingestion of chemical poisons, but it is very doubtful that there would be any spread of the disease among rats in their natural habitats; that is to say, when not confined to close contact with the sick, and that the harmlessness of the virus to man and domestic animals makes it especially useful about dwellings and public places. It cannot be expected to destroy all the rats in such a locality, however, for the reason that a certain per cent recover and become permanently immune. Whether this immunity is transmitted to their offspring I am unable to state. Next to this immunity the greatest disadvantage is the expense incident to the use of this method, a single tube of the virus costing 70 cents,

which is only sufficient to saturate one-half a loaf of rye bread. The virus can be obtained direct from the Pasteur Institut, Paris, France, or from their American agents; the directions for the use are sent with the tube.

Destroying by the Use of Predatory Animals—The time-honored use of the domestic cat and dogs, especially the terrier breeds, is too well known to require discussion. They are useful in killing and frightening away a certain number of rats from dwellings, stores and warehouses, but do not destroy enough to make them of much importance. The mongoose has been used in some countries for these purposes, but I am informed that they have not proved to be very satisfactory. It is illegal to bring this animal into the United States, and therefore it cannot be used here. The weasel and ferret have been employed to a considerable extent by professional rat-catchers, especially in large commercial houses, and while probably effective in destroying the rats, it would be a dangerous experiment to turn such animals loose upon a community. The possibility of their having the same disease that the rats are subject to; whether their powers of destruction would not be as great as those of the rats, and whether they would confine themselves to the city or go into the neighboring rural districts, where their destructiveness is well known, are serious problems to be considered before such a step is taken.

Trapping—This method, when properly applied, is capable of producing fairly good results in a limited way; but owing to the sagacity of the animal, to be entirely successful it requires some care in the choice of trap, bait, location and attention to details. It is a better method for the individual householder than for municipal authorities, as it has been found in the latter case that the loss of traps, wages of men to care for them, and the cost of keeping a horse and vehicle to move the traps from place to place, make the cost per rat destroyed far above that of poisoning and even more expensive than the offering of rewards.

There are a great many styles of traps on the market, including both those that catch the animal alive and those that either kill outright or seize the limbs and hold until the animal is dispatched. The former class are usually constructed so as to be capable of holding a large number at one time, while most of the latter have to be reset after each rat has been caught. In choosing a trap of the first class described, one point of importance is to see that the meshes are not too large, otherwise young rats will frequently make their escape. The large per cent of young rats among those trapped would seem to indicate that those of riper years are cautious about entering such devices.

Killing With Poisonous Gases in Confined

Areas—This method, while ideal on board ship, is of little service ashore, for the reason that we have few "confined areas," the animal being able to escape by the same way it enters, either into a sewer, adjoining house, or subterranean burrow. This method has been tried in the sewers to a limited extent, but it is doubtful if it is ever attended with very good results, the spaces being too large and escape ways too numerous. If it has any effect at all it would probably be to run the rat from the sewer into the house, which is to be avoided. Sulphur dioxide or chlorine gas are about the only substances that can be employed for this purpose; formaldehyde is not poisonous enough to animal life, an adult rat standing an atmosphere containing two per cent of the gas for half an hour; hydrocyanic acid and arsenureted hydrogen are too poisonous to be handled with safety; carbon disulphid, carbon monoxid, an illuminating gas, are too combustible.

Construction of Buildings and Other Methods Tending to Make the Entrance of Rats Difficult—A well constructed building, having a cement floor in the basement, with no spaces between the outer and inner wall, and with pipes leading to sewers well trapped, is a great aid to keeping a place free from these pests; and of even greater importance in this connection is the closing of all abandoned drain pipes leading from the houses into the sewer, this being the most usual route followed in traveling to and from these places.

The importance of garbage being deposited in metallic covered receptacles might be mentioned here, for the rat's food consists chiefly of what man throws away or leaves unprotected, and it will frequent only those places where such food can be most easily obtained. While not just relative to this part of the subject, it would not be too much of a digression to call attention to the advisability of requiring all ships in port to keep rat guards on their hawsers, not, as has usually been the case, for the purpose of keeping rats from coming aboard, but to prevent the landing of unnaturalized ones. In spite of this, however, some rats will leave a ship unless it is anchored well out in the stream, and swim ashore, and some ships will be near enough to the wharf to enable the rat to jump ashore, so that the importance of a wharf so constructed and of such material as to make a landing difficult or impossible should not be lost sight of.

The Use of Substances Disagreeable to the Rat, Causing It to Leave a Given Locality—This is probably the least important and most selfish method so far mentioned, and I see no place for it in properly conducted rat eradication. The most commonly used substance of this class is the so-called "chlorid of lime" of commerce. It acts by sticking to and burning the soles of the feet, when scattered in the burrows or runways of the

animal. Of the opposite of this—substances attractive to the rat—I have no knowledge. Oil of roodium is the one for which the claim is most often made, and is used to attract the animals to poison or bait.

The Offering of Rewards—This has been employed in a number of places with some success. Just how economical it would be would of course depend upon the locality and as to how badly infested it was. The average wages of the laboring class divided by the number of rats the average individual would catch in a day if he devoted his whole time to this pursuit, would probably be a rough estimate of the amount of reward per rat necessary to be attractive if large numbers were to be destroyed, although a moderate number could probably be obtained at a lower rate if such a reward were sufficient in amount to be attractive to boys. The only objections that I have heard offered to this method are: First, that attracted by the reward, some thrifty individuals have gone into the rat raising industry; and, second, that in countries where plague prevails among the rats, the number of cases might be increased by the handling of them.

The first of these objections could be met by not offering too large a reward, and withdrawing and renewing this reward without notice and at irregular intervals. The second objection would be met, partially at any rate, by the use of tongs in the handling of the dead rodents.

We see from what has been said that the methods that may be employed for the destruction of rats are numerous, each having some advantages and some disadvantages, probably a combination of several of these methods being the best way; and while the most important are being applied by the municipal authorities, it would be of advantage to, by means of a circular published in the daily papers, call upon all householders and citizens to contribute their mite to the work by destroying those about their own premises, the circular setting forth the most practical method for this purpose.

THE PRACTICAL VALUE OF THE STATE MEDICAL LAW.*

By W. W. CROSS, M. D., Visalia.

MOST of us are familiar with the State law supposed to govern the practice of medicine in the State of California only by reading it as printed in the Register. A limited experience in watching an attempt to put the law into action against an offender soon brings one to look upon the whole matter as a very complicated affair, and to wonder if something could not be done to make the present law more efficient, or sup-

plant it by another. To make a new law would mean to learn many things after it has been enacted which have been gained by experience with the present one, and it is doubtful if a new law could possibly work any better than the present one can be made to, by some changes or by other matters on the outside being adjusted to make it operate more efficiently.

When anyone guilty of violating the present law is arrested, he at once puts up all the fight in him, and brings to bear all the influence of his friends to avoid conviction. The complaining witness in the case will, without doubt, appear in court a much worse person than the party on trial, as I have had an opportunity to observe. I can safely state that all persons who were present at one trial I have in mind felt very sorry for the complaining witness in the case. The defendant generally is a man who advertises in the daily or weekly papers, and I am sorry to say that the purchase of a little advertising space in one of the so-called moral mouthpieces of the public soon lulls it to a beautiful silence, or causes it to take up the cause of the defendant for the profit gained from the advertising. They speak not of the benefit to the public in general if the law governing the practice of medicine is enforced. They do not in any way try to shape public opinion to secure a conviction, thereby suppressing a dishonest practitioner, who in almost every case is an ignorant one.

I quote here a contract which came to my hands from the patient who signed it:

Dr. M. E. L. Fredo,
Specialist and Sanitarium,
No. 714 S. Court St.,
Visalia, Cal., January 9th, 1903.

I Dr. M. E. Elfreda Here by agrees to dottor Mr. J. Salazar and furni She all Medicina and cash for the Som at fifty \$50.00 Dollare in monthly payemant \$10.00 dollar down and the balance teen \$10.00 Dollare thirty day after each month tal it all payde.

I Mrs. E. Romero I promer to pay Dottor M. E. El Fredo the abov contractts monthly payments taen \$10.00 Dollare I signo my name.

MRS. E. ROMERO.

and I Mr. J. Salazar Takey back Satha and I have to call another dottor that Mrs. E. Romero To pay eitre one I call for Mrs. Romero.

DR. M. EL FREDO.

With the above specimen before us we would not expect anyone to accuse us of jealousy, or of fear that our practice would be taken from us by a man who could do no better in an attempt at a little ordinary English. We certainly are not going to be benefited to any great extent if such a person is interfered with in his ravages upon a confiding public. Yet we can safely say that should any member in this room swear to a complaint against this party where he may now be at work, and he is still at large, it would be a sad day for the complaining witness, and he might in the end have to defend himself against

* Read before the San Joaquin Valley Medical Society, Sixteenth Annual Meeting, Fresno, October 13, 1903.